Three New Species of Dorid Nudibranchs

(Gastropoda : Opisthobranchia)

from the Hawaiian Islands

BY

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(2 Plates; 5 Text figures)

For the past several years, we have been conducting investigations on subtidal populations of nudibranchs occurring around the island of Oahu (Johnson & Bertsch, 1979; and Bertsch & Johnson, 1980 a & b; 1981). We have encountered specimens of Indo-Pacific species previously unreported from the Hawaiian Islands (*cf.* Bertsch & Johnson, 1979), and we have also collected specimens of new species of nudibranchs.

Several Hawaiian nudibranch species were erroneously identified and reported as previously named species by Kay & Young (1969). Rudman (1978) recognized the apparent uniqueness of several of these species, and referred to them as undescribed species of *Sclerodoris*. Kay (1979: 464-465) agreed with him. However, careful examination of additional material has revealed a complex of unnamed species in several genera which require more research. We have obtained sufficient material to describe 3 of them as new species in this paper. These new species are apparently endemic to the Hawaiian Islands.

Aldisidae Odhner, 1939

Aldisa Bergh, 1878

Aldisa ***pikokai*** Bertsch & Johnson, spec. nov.

(Figures 1-2 and *6-8*)

REFERENCES:

Halgerda rubra (not Bergh, 1905). Kay & Young, 1969: 194 (in part; external anatomy of smaller specimens only); not fig. 31.

Sclerodoris sp. Rudman, 1978: 76 and 86 (in part, when referring to external anatomy of Kay & Young's specimen). Kay, 1979: 465 (in part); fig. 147 C.

Aldisa sp. Bertsch & Johnson, 1981: 44-45 (includes color photographs).

EXTERNAL MORPHOLOGY AND COLORATION

Sizes of 3 living animals were 9.5, 11 and 14 mm long, and 6.5, 9 and 7 mm wide. An ovalish shaped dorid (Figure *6*), its dorsal surface is reticulated with a series of raised ridges. Where ridges meet (often 4-5 come together) they rise into a pointed peak, like a small papilla. Minute, straight spicules (6-10 in number) protrude outward from each papilla. Viewed with a dissecting microscope at 250 x, sheets of spicules can be seen lying underneath the integument. Dorsum is rigid and slightly convex. A thin mantle margin overhangs edges of foot. Rhinophores and gills are positioned relatively far anteriorly and posteriorly,

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respectively. In a preserved specimen 14 mm long the rhinophores were 2.5 mm apart, and 3 mm from the anterior edge of the animal; the gills were about 2.5 mm from the posterior edge of the mantle. On the midline of the dorsum are 3 depressions, giving the animal a cratered appearance. These pits vary in outline (circular to ovalish), and are each surrounded by a raised rim. One pit lies just anterior to the rhinophores, the next pit is immediately posterior to the rhinophores and the third is just anterior to the gills. All three are each within 1 mm of either the rhinophores or gills. The size of these pits does not vary significantly in proportion to the size of the adult animals. In living specimens measuring 9.5, 11 and 14 mm long the diameters of the pits in each animal were: 1, 1.75, and 1.5 mm; 0.5, 1, and 1 mm; and 0.5, 2, and 1.5 mm, respectively. The pits of a preserved specimen 14 mm long were 1, 2 and 1.75 mm in diameter.

Basic body color of living animal is an orange-red with infrequent dust-like patches of cream white on the sides of the dorsum. Rhinophores are orange-red, gills cream white. Inside the pits are numerous small dark maroon-black pigmented spots (see Bertsch & Johnson, 1981: 44-45).

Additional descriptions of the external anatomy (smaller specimens only) are given by Kay & Young, 1969: 194, and Kay, 1979: figs. 147 C and p. 467.

RADULA:

Figure 1

Two radular teeth of *Aldisa pikokai*, approximately 400 × (specimen HB 754 B; paratype)

Buccal tube contains a multitude of elongate thin teeth (Figure 7); "dont les éléments sont aussi difficiles à compter que ceux d'une chevelure hirsute!" (Pruvot-Fol, 1954: 268). One specimen (HB 754-B) had approximately 85 + teeth per half-row, whereas a larger specimen (HB-753-A) had about 120 teeth per half-row (with around 200 total rows). Because of the thinness and overlapping of teeth, the row patterns are extremely difficult to discern. Each tooth is broadened at the base, becoming thin throughout most of its length, then widening into a flat, spatulate shape distally (Figure 1). The broader end has a series of about 18-25 small up-curved denticles (Figure 2) along one side. At the extreme distal point the serrations become very long and thin, often folding back over the tip (Figure 8).

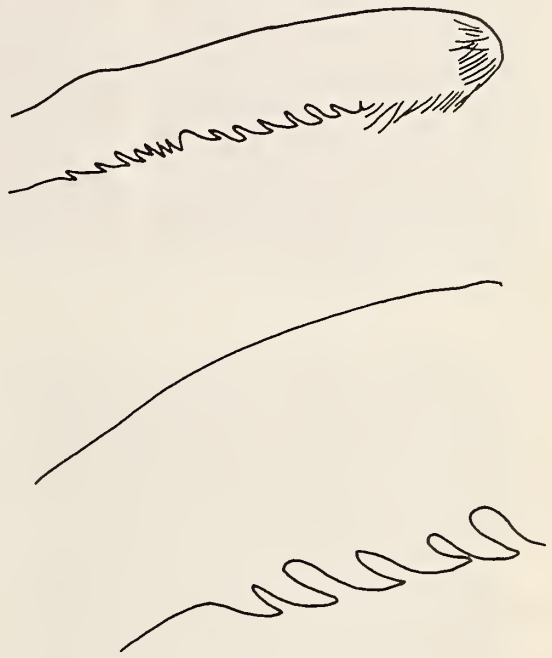

Figure 2

Close-ups of distal end of tooth, showing fine serrations. Upper tooth, approximately 2250×, lower drawing approximately 5600× (*Aldisa pikokai* specimen HB 754 B)

Note added in proof;

We sent Dr. Sandra Millen (University of British Columbia, Canada) a specimen of *Aldisa pikokai*, and she graciously furnished us this description of its reproductive system:

"The ovotestis forms small oval lobules on the surface of the digestive glands. The thin hermaphroditic duct leaves above the esophagus and travels anteriorly to the saccate, u-shaped ampulla. This ampulla narrows to a short duct which branches to the prostate, to the short uterine duct and to a long duct which travels upward across the albumen gland.

"The elongate prostate is u-shaped, the non-prostatic portion of the vas deferens narrows and coils slightly, widening into a muscular portion terminating at the penis. The penis is armed with spines. The thorn-like spines, 10 μm long, are arranged in 6 rows, of approximately 11 per row.

"The female gland has a separate nidamental opening ventral to the male-female opening. The mucus and membrane portion is highly pigmented, orange in alcohol. The granular white albumen gland is located centrally.

"The vagina is connected to a common atrium. It is long and tubular, muscular near the atrium, narrowing slightly and ending in the small, round bursa copulatrix At this junction emerges the duct to the semi-serially arranged receptaculum seminis. Two-thirds of its length along it bifurcates, recurving to the rounded receptaculum seminis and sending off a long, thin uterine duct to enter the base of the albumen gland."

MATERIAL EXAMINED AND DISTRIBUTION:

1) Holotype. 5 m subtidal, Makua, Oahu; *leg.* Scott Johnson (SJ), 17 August 1978 (HB 753-A). This dissected specimen and its mounted radula have been placed in the collections of California Academy of Sciences, Department of Invertebrate Zoology, CASIZ 019702.

2) Paratype. 5 m subtidal, Makua, Oahu; *leg.* SJ, 30 April 1979, night scuba dive. Undissected specimen in the Malacology Department, Bernice P. Bishop Museum, Honolulu, Cat. No. 207078.

3) Paratypes. 2 specimens, 5 m subtidal, Makua, Oahu; *leg.* SJ, October 1978 (HB 754). Alcohol preserved specimens and mounted radula slides, San Diego Natural History Museum, Department of Marine Invertebrates, Type Series SDNHM No. 800.

4) Additional Material. 1 specimen, 5 m subtidal, Makua, Oahu; *leg.* SJ, 10 May 1979, night scuba dive (HB 840); 1 specimen, 9-10 m subtidal, Pupukea, Oahu; *leg.* SJ, 9 July 1979, night scuba dive (HB 841); 1 specimen, 5 m subtidal, Makua, Oahu; *leg.* SJ, 19 September 1979, night scuba dive (HB 842); 1 specimen, 14 m subtidal, Ewa, Oahu; *leg.* SJ, 13 October 1979; 1 specimen, 24 m, Haleiwa Trench; *leg.* Hans Bertsch (HB), Judith Bertsch, and Jane Culp, 17 August 1980.

5) 1 specimen, 8 m, Puako, Hawaii; seen by SJ, 20 May 1978. 11 specimens, 2, 8 and 10 m, Puako, Hawaii; seen by SJ, 8, 9, 11, 12 and 14 August 1980.

6) More than 100 specimens have been seen while night diving at Pupukea and Makua, 1978-1980 (see Table 1).

We have temporal and bathymetric data on 134 specimens of *Aldisa pikokai.* The species is nocturnal; we observed 124 animals at night and 10 during daylight hours. Eight of the daylight-found animals were under rocks, and 1 was at the bottom of the Haleiwa Trench (the deepest specimen recorded); these situations are relatively dark habitats for the animal.

Aldisa pikokai occurs in the shallow subtidal zone. We found 32 specimens between 2-12 m deep, 1 in 14 m, and 1 in 24 m (the Haleiwa Trench specimen). The median depth at which we found specimens was 2-6 m; over 75% of the animals were collected between 2-8 m (Table 4).

TYPE LOCALITY:

Shallow subtidal cliffs off of Makua, Oahu (21°32′50″ N; 153°13′32″ W); Hawaiian Islands.

ETYMOLOGY:

This new species name is a combination based on the Hawaiian words *piko* (navel) and *kai* (sea), forming a genitive ending of the second declension (only one -i used

Explanation of Figures 6 to 12

Figure 6: *Aldisa pikokai,* collected at Pupukea, night diving in 10 m of water

Figure 7: Radular teeth of *Aldisa pikokai* (specimen HB 754 B); low magnification scanning electron micrograph showing the characteristically thin, elongate teeth × 115

Figure 8: Distal tip of radular tooth of *Aldisa pikokai,* × 5600

Figure 9: Holotype of *Sclerodoris paliensis,* photograph of living animal (HB 755)

Figure 10: SEM of anterior half of radula of *Sclerodoris paliensis* Specimen illustrated, HB 755, holotype × 20

Figure 11: Posterior half of radula, left side, of *Sclerodoris paliensis* × 20

Figure 12: Posterior half of radula, right side, of *Sclerodoris paliensis* × 20

Figure 6

Figure 7

Figure 8

Figure 9

Figure 10

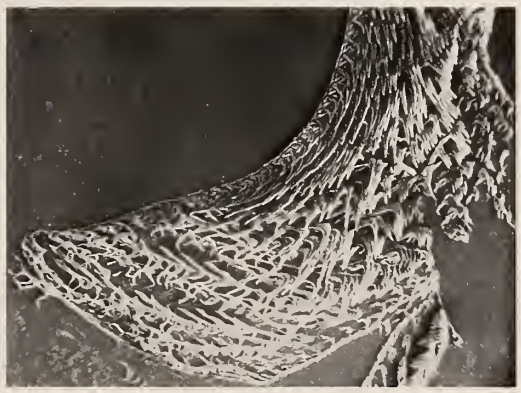

Figure 11

Figure 12

Table 1

Monthly occurrences of specimens of *Aldisa pikokai,* seen (not collected) at Makua and Pupukea, Oahu.

Month	Makua	Number of scuba dive searches	Pupukea	Number of scuba dive searches	Total animals	Total searches
January	8	2	—	—	8	2
February	1	1	—	—	1	1
March	9	2	1	1	10	3
April	11	3	—	—	11	3
May	—	—	7	1	7	1
June	13	2	—	—	13	2
July	12	2	4	2	16	4
August	12	2	3	2	15	4
September	18	4	—	—	18	4
October	3	1	—	—	3	1
November	—	—	—	—	—	—
December	11	3	—	—	11	3

for euphony), and meaning sea navel, in reference to the poem:

Pohaku piko	Navel stone
Piko honua	Earth navel

According to the traditions of the Hawaiian people, the "child's navel cord attaches him to his mother and family. He will be attached also to the place where the cord is deposited after his birth. If it is placed in the sea, he will live from the sea. If his cord is pounded firmly into the crevice of the proper stone, he will be forever a child of the land which nurtures him" (Charlot, 1978). The dorsal pits on *Aldisa pikokai* are reminiscent of the cupule style petroglyphs fashioned on pahoehoe lava flows (at Puuloa, Hawaii) in which were deposited the children's navel cords (Cox & Stasack, 1970: 21-24).

DISCUSSION:

In their study of the Hawaiian dorids, Kay & Young (1969: 194-195) identified 3 red nudibranch specimens as *Halgerda rubra* Bergh, 1905. Rudman (1978: 76) considered that these specimens were an unnamed new species of *Sclerodoris,* which opinion Kay (1979: 465) followed. Neither author examined additional specimens. However, Kay & Young's original material, collected in 1965-1966, is actually a composite of several species. Their external description and the smaller measurements were based on specimens of our new species, *Aldisa pikokai.* The internal descriptions are not referable to any material we have examined.

Species of the monotypic family Aldisidae are characterized by a highly aberrant radula, composed of fine, elongate teeth, serrated and spatulate at the distal extremity (*cf.* illustrations in Pruvot-Fol, 1954: 267-269; fig. 106; Marcus, 1961: 16; fig. 53; Ferreira & Bertsch, 1975: 328; figs. 11-14). The living animals tend to be small dorids (usually less than 30 mm) and colored in varying shades of yellow orange or red (Behrens, 1980: 50).

The dorsal surface of all previously known species of *Aldisa* is papillose, tuberculous, or verrucose. The dorsal surface textured with ridges and pits is a unique morphological feature that immediately separates *Aldisa pikokai* from the 6 known species of *Aldisa.*

This new Hawaiian species of *Aldisa* is also geographically isolated from all its congeners. *Aldisa banyulensis* Pruvot-Fol, 1951, *A. berghi* Vayssière, 1901, *A. binotata* Pruvot-Fol, 1953, and *A. zetlandica* (Alder & Hancock, 1854) occur along the North Atlantic or Mediterranean coasts (see Thompson & Brown, 1976: 124; and Pruvot-Fol, 1954: 268-269). These species are finely or grossly papillated on the dorsum, and lack any hint of the reticlated ridges seen on *Aldisa pikokai.* Moreover, *Aldisa zetlandica* is a gray-green color.

Aldisa cooperi Robilliard & Baba, 1972, occurs around the margins of the north Pacific, in Japan, northern British Columbia, Canada, Washington, and California, USA (Lambert, 1976). *Aldisa sanguinea* (Cooper, 1863) ranges from Coos Bay, Oregon (Belcik, 1975), to San Diego, California, and in the Gulf of California, Mexico (Ferreira & Bertsch, 1975: 327-328). The records of *A.*

cooperi in California (Robilliard & Baba, 1972: 412) and *A. sanguinea* in Oregon suggest a sympatric and not allopatric distribution. Hence, *A. cooperi* is here given full specific status, although originally named as a subspecies. Both species can be distinguished from *A. pikokai* by their papillated notum and their patterns of black coloration (two large blotches or many small specks).

Aldisa nhatrangensis Risbec, 1956, is a synonym of *Actinocyclus japonicus* (Eliot, 1913) (Kay & Young, 1969: 217).

Halgerdidae Odhner, 1926

Sclerodoris Eliot, 1904

Sclerodoris paliensis Bertsch & Johnson, spec. nov.

(Figures 3-4, and *9-14*)

REFERENCES:

Sclerodoris sp. Bertsch & Johnson, 1981: 45 (includes color photograph).

EXTERNAL MORPHOLOGY AND COLORATION:

Maximum length of living animal is about 65 mm; preserved lengths of 5 specimens were 28, 34, 37, 45 and 51 mm. Dorsal surface is evenly convex and heavily criss-crossed with anastomosing ridges. The junctures of 3-5 major ridges are further raised as prominent papillae (Figure 9). One's immediate impression on viewing this animal is of the large size of the ridges compared with the gouged-out pits between them. Rhinophores of 42 mm long animal were positioned 7 mm from the anterior edge of body, 10 mm apart (body width 22 mm).

Body coloration is a dirty yellow to yellow-orange. Some of the ridges are a darker and denser yellow. A delicate, thin white line edges the notum; some have none, while others have a lightly frosted appearance. The gills are a dirty cream color; the rhinophores are yellow basally, dusty brown in the broader area of the perfoliations, tipped in white distally (see Bertsch & Johnson, 1981: 45).

INTERNAL ANATOMY:

The combined radular formula from 7 specimens is 37-44 (33-45·0·33-45). Table 2 gives the individual formulae. Radular teeth are simply hamate (Figures 3 and *10-12*); innermost teeth have short and strongly curved cusps, becoming progressively longer and straighter in the center of each half-row. Outermost lateral teeth are shorter and straight (Figure *13*). Newly developing teeth (Figure *14*) are weaker and thinner, characteristic of such teeth (Bertsch, 1976)

Table 2

Radular formulae of *Sclerodoris paliensis.*

Specimen	Formula	Length of animal
HB 755	43 (41.0.41)	42 mm alive
HB 845	44 (33.0.33)	
HB 844 a	42 (45.0.45)	37 mm preserved
HB 844 b	41 (38.0.38)	45 mm preserved
HB 844 c	38 (36.0.36)	34 mm preserved
HB 844 d	42 (43.0.43)	51 mm preserved
HB 846	37 (37.0.37)	28 mm preserved

The newest radular teeth begin growing on the outermost portion of the most posterior tooth row. As the tooth row advances, the central and inner teeth of each half-row are formed. Thus, progressive inward growth of the developing tooth rows is mirrored in the increased number of teeth. The ultimate tooth row of one specimen had 11 teeth in the half-row (row 42, right side of radula, HB 844 A); the penultimate row (number 41) had 21 teeth in the half-row, and row 40 had 27 teeth.

The radulae of bigger specimens tend to be larger because of increased tooth size, not an increased number of rows of teeth.

The reproductive system (Figure 4) is similar to that of other species of *Sclerodoris*. There is a distinct prostate, a spermatocyst (exogenous sperm sac) attaches near the prostate and ampulla, and no accessory gland opens into the vestibule housing the genital apertures.

MATERIAL EXAMINED:

1) Holotype. 5 m subtidal, Makua, Oahu; *leg.* Scott Johnson, 24 August 1978, night (HB 755). This dissected specimen and its mounted radula have been placed in the collections of California Academy of Sciences, CASIZ 019700.

2) Paratype. 5 m subtidal, Makua, Oahu; *leg.* SJ, 10 May 1979, night (HB 846). Alcohol preserved specimen and mounted radular slide, San Diego Natural History Museum, Department of Marine Invertebrates, SDNHM T.S. 802.

3) Additional material. 1 specimen, subtidal, Makua, Oahu; *leg.* SJ, April 1977 (color transparency, specimen not col-

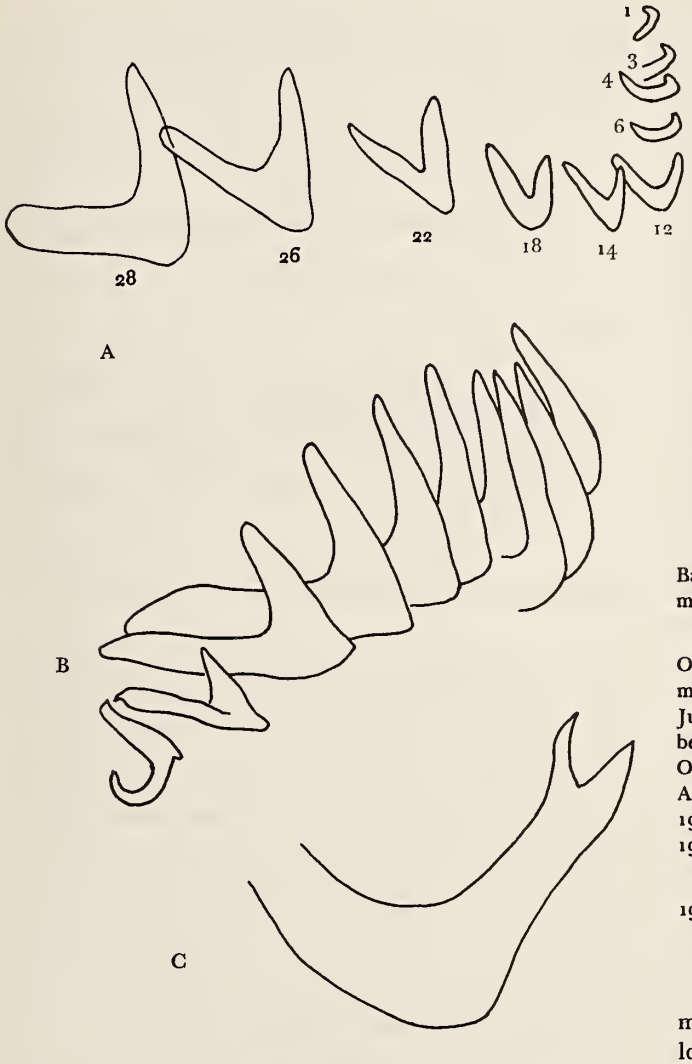

Figure 3

Radular teeth of *Sclerodoris paliensis*:

A. Selected teeth from row 25, right side (specimen HB 845; collected in 10m at Pupukea by S. Jazwinski, 15 March 1979); approximately 200 ×

B. Outer 10 teeth of row 10, right side (specimen HB 845) approximately 200 ×

C. Anomalous tooth shape (bicuspid), present in tooth 4, right side, rows 7 through 29 (specimen HB 846, paratype)

Figure 4

Sketch of reproductive system of *Sclerodoris paliensis* (specimen HB 844 B)

lected); 4 specimens, 5 m, Makua, Oahu; *leg.* SJ, 25 January 1979, night (HB 844); 1 specimen, 10 m, Pupukea, Oahu; *leg.* Stan Jazwinski, 15 March 1979; 1 specimen, dredged 500 feet [150 m] from sand and coral rubble bottom, due west off Pokai Bay; *leg.* Richard Salisbury, 1976 (not seen; *fide* personal communication R. Salisbury).

4) Other animals were seen by SJ, night diving at Makua, Oahu, but not collected: 2 specimens, 10 March 1978; 3 specimens, 17 April 1978; 1 specimen, 9 June 1978; 3 specimens, 8 July 1978; 4 specimens, 17 August 1978; 3 specimens, 11 September 1978; 3 specimens, 25 September 1978; 3 specimens, 20 October 1978; 5 specimens, 25 December 1978; 5 specimens, 13 April 1979; 1 specimen, 20 April 1979; 1 specimen, 30 April 1979; 2 specimens, 20 September 1979; 1 specimen, 5 December 1979; 2 specimens, 3 January 1980; 1 specimen, 29 July 1980.

5) 3 specimens seen at Puako, Hawaii, 5-10 m, 9-14 August 1980, SJ.

Sclerodoris paliensis is nocturnal; 51 (out of 52) animals were collected at night. It usually occurs in the shallow subtidal zone. Similar to *Aldisa pikokai,* the median depth at which we found specimens was 2-6 m; 75% of the animals were collected between 2-6 m (Table 4).

TYPE LOCALITY:

Shallow subtidal cliffs off of Makua, Oahu (21°32′50″ N; 153°13′32″ W).

ETYMOLOGY:

Based on the Hawaiian word for cliff, *pali,* the species name was chosen because the steep ridges on the animal's notum bear a resemblance to the steep cliff face characteristic of erosion of an extinct volcano in the Hawaiian Islands.

DISCUSSION:

This species apparently has not been reported previously from Hawaii nor elsewhere in the Indo-Pacific, not even as a misidentified specimen, by other workers.

Rudman (1978) reviewed the genus *Sclerodoris* as comprised of 8 Indo-Pacific species. One of these, *Sclerodoris* sp. A., he separated from *Halgerda rubra* under which identification Kay & Young (1969) published a description of their specimens. We have shown that part of this material is actually our new species of *Aldisa,* and therefore need not be compared with *Sclerodoris paliensis.* Recently, Bertsch (1981) has recognized one other species in this genus: the Californian-west Mexican *Sclerodoris tanya* (Marcus, 1971), the first non-Indo-Pacific *Sclerodoris* known.

Sclerodoris tuberculata Eliot, 1904, and *Sclerodoris* sp. B. (*sensu* Rudman, 1978: 86) both have denticles on their outermost radular teeth; these teeth are smooth in *Sclerodoris paliensis.* The outermost teeth of *Sclerodoris coriacea* Eliot, 1904, have one large cusp and a number of irregular projections, a trait not shared by *S. paliensis;* moreover the body texture of *S. coriacea* is different—with many close tubercles, and without the prominent ridging of *S. paliensis.* The enigmatic *Sclerodoris osseosa* (Kelaart, 1859), reported from Ceylon and Africa, has an indistinct dorsal ridge, with "one pit larger and more conspicuous than the others" (Eliot, 1904: 380), traits not present in *S. paliensis* (see Rudman, 1978: 85-86, for a discussion of Hawaiian specimens identified as *Trippa osseosa* by Kay & Young, 1969). Both *S. tuberculata* and *S. apiculata* Alder & Hancock, 1864, have an accessory gland in their reproductive system, absent in *S. paliensis.* Notal texture is also useful for specific separation: *Sclerodoris japonica* (Eliot, 1913) has a back closely covered with villous papillae; *S. tarka* Burn, 1969, and *S. apiculata* have a delicate style or filament projecting from each tubercle; *S. tanya* has a complicated texture which includes pits or holes in the walls of the main concavities and depressions. These characters do not occur in *S. paliensis.*

The genus *Peronodoris* Bergh, 1904, has been variously synonymized with *Sclerodoris* (Thiele, 1931; Allan, 1947), considered a distinct genus (Marcus & Marcus, 1970) or thought in need of further material before a decision could be made (Rudman, 1978). Without proffering an opinion regarding the status of *Peronodoris,* we feel that our new species should be compared with the 3 species placed within that genus because of their distinct notal ridging and possible close affinities with *Sclerodoris.* The differences can be summarized succinctly: *Peronodoris cancellata* Bergh, 1904, has no prostate; and *P. denticulata* Eliot, 1908, and *P. rehderi* Marcus & Marcus, 1970, have teeth with denticles.

Halgerda Bergh, 1880

Halgerda terramtuentis Bertsch & Johnson, spec. nov.

(Figures 5, and *15-18*)

REFERENCES:

Halgerda sp. cf. *graphica* (Not Basedow & Hedley, 1905.) Kay & Young, 1969: 193-194; figs. 28 and 30. Rudman, 1978: 84. Kay, 1979: 474; fig. 147 E.

Halgerda graphica. Bertsch *in* Sumich, 1980: plt. 6-D (color photograph).

Halgerda sp. Bertsch & Johnson, 1981: 46-47 (includes color photographs).

EXTERNAL MORPHOLOGY AND COLORATION:

Sizes of 26 living animals ranged from 15-50 mm in total length ($\bar{X}$ = 29.9 mm); over $\frac{2}{3}$'s of the animals measured 25-50 mm. This is a much wider range of size than the 25-30 mm reported by Kay & Young (1969). This oval shaped dorid has a convexly inflated dorsal region (Figure *15*). Its body is a firm, gelatinous, smooth texture, with harder pustules scattered over the notum. Mantle margins are thin, at times appearing slightly scalloped or crenulate. Body is a translucent white (viscera visible through integument as darker areas), and the notum is covered with a network of yellow-gold lines, forming irregular polyhedrons. White pustules occur at the juncture of the lines. Mantle is margined with a complete yellow-gold edging. The long slender rhinophores and gills (2 branchiae which further divide) are white with black spotting (see Bertsch & Johnson, 1981: 46-47).

INTERNAL ANATOMY:

The combined radular formula from 5 specimens (including Kay & Young's) is 55-62 (45-61·0·45-61) Individual formulae are listed in Table 3. The radular teeth have smooth, hamate cusps, increasing in length in the middle of each half-row (Figure *16* of this paper; see also Kay & Young, 1969: figs. 28-B). Outermost teeth decrease to nearly scythe-like blades (Figure *17*). Newly developing teeth are exceedingly thin (Figure *18*). Some of the central teeth (Figure 5) are longer, thinner and straighter than

Table 3

Radular formulae of *Halgerda terramtuentis.*

Specimen	Formula	Length of animal
HB 702 (SEM)	59 (45.0.45)	21 mm preserved
HB 727	61 (59.0.59)	42 mm preserved
HB 742 a	51 (50.0.50)	18 mm preserved
HB 855 a	62 (61.0.61)	32 mm preserved
Kay & Young (1969)	55 (56.0.56)	30 mm

the thicker shapes illustrated by Kay & Young. This variation is certainly not considered a significant difference. The major component of radular size variation between larger and smaller specimens appears to be size of teeth and not number of rows.

Reproductive system has been described and figured by Kay & Young (1969: 193-194; fig. 28-A).

Figure 5

Tooth of *Halgerda terramtuentis,* dissected from near the middle of row 15, left side (specimen HB 727, paratype)

MATERIAL EXAMINED AND DISTRIBUTION

1) Holotype. 22.9 m, subtidal, about 1-2 km offshore from Waikiki, Oahu; *leg.* Hans Bertsch, 16 September 1978 (HB 702). This dissected specimen and its mounted radula have been placed in the collections of California Academy of Sciences, Department of Invertebrate Zoology, CASIZ 019701.

2) Paratype. 15.2 m, off Halona Blowhole-Lanai Lookout Cliffs, Oahu; *leg.* HB & SJ, 26 September 1978 (HB 727). Alcohol preserved specimen and mounted radular slide, San Diego Natural History Museum, Department of Marine Invertebrates, SDNHM T.S. 804.

3) Additional material. (Mostly seen and photographed *in situ,* not collected). 2 specimens, 21.3 m, boat dive off Makaha, Oahu; HB & Judith Bertsch, 17 September 1978; 2 specimens, 15.2 m, Pupukea, Oahu; HB & SJ, 21 September 1978; 1 specimen, 16.8 m, Makua Ledge, Oahu; HB & SJ, 2 October 1978; 1 specimen, 35 m, off Lahi Lahi Point, Makaha, Oahu; HB & Judith Bertsch, 10 December 1978.

6 specimens, 6 m, Three Tables, Oahu; HB & Rosemary Dorostkar, 30 June 1979; 2 specimens, 15 and 25 mm in length, 12 m, Makua Ledge, Oahu; HB & Scott Greenberg, 5 July 1979; 2 specimens, 6 m, Three Tables, Oahu; HB & Jane Kent, 6 July 1979; 2 specimens, 20 mm long, 12 m, Makua Ledge, Oahu; HB, Jane Kent, and Rebecca McElroy, 11 July 1979; 2 specimens, 15 and 25 mm long, 22.9 and 20 m, Haleiwa Trench, Oahu; HB & Scott Greenberg, 12 July 1979; 2 specimens, 17 and 25 mm long, 18.3 m, boat dive off Waikiki, Oahu; HB, Rebecca McElroy, Jane Kent, and Ed Baughman, 15 July 1979.

1 specimen, 30 mm long, 10.7 m, Pupukea, Oahu; HB, 21 June 1980; 1 specimen, 32 mm long, 4.6 m, Nanakuli Beach Park, Oahu; HB & Cathie Diekmann, 29 June 1980; 1 specimen, 30 mm long, 12 m, Three Tables, Oahu; HB, Cathie Diekmann & Caroline Boeckman, 3 July 1980; 2 specimens 45 and 22 mm long, 18.3 and 16.8 m, Haleiwa Trench, Oahu; HB, Judith Bertsch, and Dan Gieschen, 4 July 1980; 4 specimens, 38, 40 and 40 mm long (9.1 m) and 50 mm long (7.6 m), on roof of lava tube, Three Tables, Oahu; HB & Judith Bertsch, 5 July 1980; 1 specimen, 40 mm long, 12 m, Pupukea, Oahu; HB, Dodie Anderson, and Cathie Diekmann, 8 July 1980; 3 specimens, 23 and 28 mm (12 m) and 20 mm long (12.8 m), Makua Ledge, Oahu; HB & Dodie Anderson, 15 July 1980; 3 specimens, 36, 30 and 30 mm long, 12.5, 12, and 12.8 m, the cave west of Makua, Oahu; HB & Jane Culp, 20 July 1980; 2 specimens, 25 mm long, 20.7 and 15.2 m, boat dive off Makaha, Oahu; HB & Judith Bertsch, 27 July 1980; 1 specimen, 36 mm long, 6.7 m, Three Tables, Oahu; HB & Jane Culp, 15 August 1980; 1 specimen, 35 mm long, 9.1 m, Pupukea, Oahu; HB & Judith Bertsch, 24 August 1980.

1 specimen, 54 mm long, subtidal, Kona, Hawaii; *leg.* A. J. Ferreira, June 1973.

Kay & Young (1969: 194) found only 4 specimens of this species (2 were collected from 13 m depth) during over 4 years of regular monthly littoral collections. Our 3 years of scuba diving have yielded over 100 specimens of *Halgerda terramtuentis.* Only 60% of the animals were seen between 2-6 m deep (Table 4).

In an earlier work studying Chromodorididae nudibranchs, we have contrasted the results of our subtidal field work to Kay & Young's (1969) intertidal data (see Bertsch & Johnson, 1980). We have found definite zonation preferences among the species of chromodorids for the intertidal or subtidal regions and different bathymetric ranges within the subtidal zone. In a similar fashion, there are distinct habitat and niche differences among

Table 4

Bathymetric distribution of *Aldisa pikokai, Sclerodoris paliensis,* and *Halgerda terramtuentis.* The large numbers of animals seen in the 2-6 m depth range partially reflects intensive observations by SJ at this depth; however, the relative proportions between the different depth occurrences and between the species indicate that *H. terramtuentis* is more common deeper.

	Number of animals		
Depth in meters	*Aldisa pikokai*	*Sclerodoris paliensis*	*Halgerda terramtuentis*
0 - 4	1	—	1
(2 - 6)	84	40	66
5 - 8	19	9	10
9 - 12	28	2	18
13 - 16	1	—	6
17 - 20	—	—	5
21 - 24	1	—	4
25 +	—	1 (dredged)	1
Total animals	134	52	111
Nocturnal (observed while night diving)	124	51	35 (all from 2 - 6 m)

the 3 species described in this paper. *Aldisa pikokai* has a remarkably different radular tooth morphology from both *Sclerodoris paliensis* and *Halgerda terramtuentis.* Our new species of *Aldisa* and *Sclerodoris* both occur more commonly in the shallow subtidal area and are nocturnal. The new *Halgerda* occurs more frequently in deeper water and is both diurnal and nocturnal.

TYPE LOCALITY:

About 1-2 km offshore from Waikiki Beach, Oahu (21°16′30″ N; 157°50′30″ W).

ETYMOLOGY:

The species name is an interpretive Latin translation for an Earthwatch team member (literally, "of the one looking at the earth with care"), to acknowledge the support and help given our research by the volunteer Earthwatch expeditions "Hawaii's Colorful Mollusks," during the summers of 1978, 1979, and 1980.

DISCUSSION:

Halgerda terramtuentis needs to be clearly distinguished from *Halgerda graphica* Basedow & Hedley, 1905. The radula is similar, and cannot be distinguished by meristic characters. The teeth of both species have simple hamate cusps, but Basedow & Hedley's illustrations of the Australian species indicate thinner teeth with a weaker base than Kay & Young and we have found in the Hawaiian species. The coloration is significantly different and immediately reliable for specific determination. *Hal-*

Explanation of Figures *13* to *18*

Figure *13*: Close-up SEM of anterior-most 4 rows of radular teeth of *Sclerodoris paliensis* (upper right hand portion of Figure *10*) × 110

Figure *14*: Posterior-most rows of developing radular teeth of *Sclerodoris paliensis* (enlargement of lower center of Figure *11*) × 50

Figure *15*: *Halgerda terramtuentis* photographed crawling at 9 m depth, Makua, in a strong current (2 October 1978). This illustration appeared as a color photograph in Sumich, 1980: plt. 6-D

Figure *16*: Radula of *Halgerda terramtuentis* (HB 702); SEM of posterior ⅔ of radula, showing developing rows and fully formed teeth × 60

Figure *17*: Outermost lateral teeth of *Halgerda terramtuentis* (enlargement of lower center of Figure *16*) × 300

Figure *18*: Newly developing teeth of *Halgerda terramtuentis* (enlargement of upper left hand quadrant, Figure *16*) × 300